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LIGHTING EQUIPMENT OF FERRY STEAMER "THOROUGHFARE"

BY H. A. RUSSELL

There was recently added to the transportation facilities of San Francisco Bay a double end ferry 273 ft. long, with a gross tonnage of 3600, driven by two tandem compound engines of 1340 indicated horsepower. This steamer (see Fig. 1), was built for the Southern Pacific Company, and was expressly designed for the transportation of automobiles across the bay between San Francisco and Oakland.

Fig. 1. Ferry Steamer "Thoroughfare."

When it was decided to equip the new steamer with electric searchlights it was found that there was not sufficient room in the engine compartment to house additional engine-driven generators to supply current for the searchlight projectors. Under these conditions it was decided to take advantage of the compact arrangement and relatively light weight of the Curtis steam turbo-generator, and two units of 25 kw. capacity were secured from the General Electric Company and installed on a level with a gallery platform in the engine room, but were separately supported by iron brackets fastened to the side of the ship. The turbo-generators when mounted in this way were 9 ft. above the keel, and as they did not occupy space which could otherwise be utilized, they did not interfere in any way with the original layout of the engine room. The appearance of these generator sets is shown in the accompanying illustration, Fig. 2. They operate condensing at 3600 r.p.m., utilizing 175 lb. steam pressure with 26 in. vacuum. They are provided with throttle valve, steam gauge, oil pressure gauge, separate regulating governor, and, in addition, are equipped with emergency stops. They are direct connected to the main steam pipe line.

The generators are compound wound machines and deliver direct current at 110 volts. The searchlights are standard 13-in. General Electric pilot house control type, equipped with silver glass mirrors, and are installed on the tops of the two pilot houses. By means of a single lever, which is within easy reach of the pilot, the beam of light can be readily moved in either a horizontal or vertical direction and the pro-

jector may be locked at any desired angle by simply turning the handle of the lever until it binds against the quadrant.

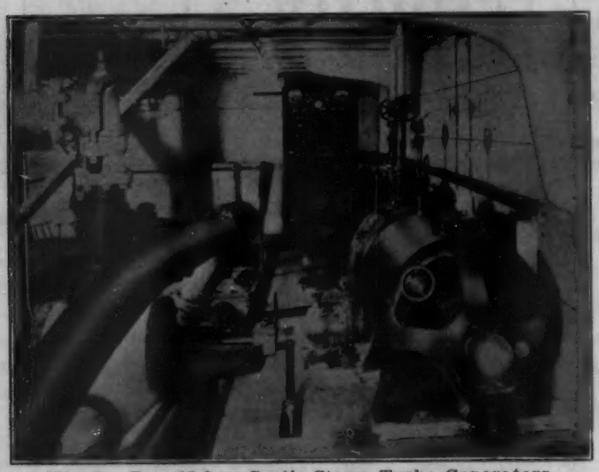


Fig. 2. Two 25 kw. Curtis Steam Turbo-Generators and Switchboard.

The control panel for the turbo-generators is installed at one end of the platform containing the lighting sets, and the field rheostats are mounted back of the panel board.

Fig. 3. San Francisco Ferry Tower Illuminated by Ferry Boat Searchlight.

In addition to the searchlights the steamer is provided with two sets of electric running lights with auxiliary tell-tale boards, which give a constant indication of the condition of the lights, while for the ordinary lighting throughout the ship, 250 16 c.p. incandescent lamps have been provided.

SAFEGUARDING THE CHILDREN.

The many distressing accidents in our Western cities during the past year among the children playing in the streets where electric cars and vehicles are passing constantly have lead serious-minded citizens to endeavor to provide ways and means for a lessening in the fearful death toll.

In the great city of Philadelphia an accident prevention crusade under the leadership of the Philadelphia Rapid Transit Company has resulted in formulating rules of warning to the children and parents. The rules with the assistance of the board of education have been placed in the hands of thousands of parents and children. Good results are already being experienced.

Instruct your little ones to look in both directions before attempting to cross, particularly upon double-tracked streets. The middle of the block is always dangerous—use the crosswalks.

Strangely enough, the usually harmless game of "tag" adds heavily each year to the total number of those injured in the public streets.

The spirit with which most children enter into the game makes them quite careless of almost every form of danger.

Whenever possible, children should be encouraged to make use of the public playgrounds for their sports, instead of the crowded city streets. Frequent cautionings will prevent many accidents of this character.

Teach the children:

To head the warning gong or horn.

To make safety their first thought.

To give moving vehicles the right of way.

To let fallen or dangling wires alone.

To play ball or tag on the lots and not in the streets.

To be careful at railroad crossings.

To avoid dangerous places while roller skating.

To keep away from open ditches, lumber or brick piles.

To never "hook rides" upon cars, wagons, or automobiles.

To wait until the car has stopped before attempting to get on or off.

TOO MANY COATS OF PAINT DO NOT PROTECT THE IRON.

In an article on the subject of the protective qualities of paint in the Zeitchrift fur Elektrochemie for February 1, 1912, and abstracted in the A. S. M. E. Journal, it was stated that the commonly accepted belief that several coats of paint protect iron from rusting better than one coat is fallacious. The author's experiments with many kinds of paint have uniformly shown that the tendency of iron to rust was in direct proportion to the number of coats of paint which were applied. This phenomenon is believed to be due to electric action at the surface of the iron with the different coats of paint, the greater number of points of contact with different layers giving rise to a greater electrolytic action.

CRITICISM OF PRESENT CALIFORNIA LAW ON OVERHEAD CONSTRUCTION.

Much discussion has of late appeared in the columns of this Journal relative to the present California law on overhead construction.

At a meeting of the California delegates to the convention of the National Electric Light Association at Seattle recently, a definite movement was started for securing the revision of the California State Law governing overhead line construction. This law is known as chapter 499, Statutes of 1911, and was printed in full in these columns in our issue of February 3, 1912. Further discussion appears in our issue of June 22, 1912.

Represented at the meeting held in Seattle were a number of the largest operating companies in California and it was agreed that each company would immediately make a draft of the changes which would be necessary in the law, in order to make it a safe and efficient regulation, the understanding being that a joint meeting would be held at some central point for the purpose of agreeing on a final draft for submission to the proper authorities.

Mr. E. R. Northmore represented the Los Angeles Gas & Electric Corporation at Seattle and at his request, the Joint Pole Committee of Los Angeles has held a number of meetings for the discussion of all phases of the law, In this issue of the Journal is found a criticism and draft of a revised law which are the result of the Committee's deliberations. It should not be inferred that this draft is considered a model in any respect but some of the impossible features of the existing law have been eliminated. The committee are a unit in recommending the repeal of the entire law and the substitution therefor of the specifications of the National Electric Light Association.

A meeting will be held in San Francisco at an early date for final discussion of this subject.

Some Notes on the Present Law.

Paragraphs (a) and (b): The standard distance of thirteen (13) in. from center of pole to wire or cable has been selected without any apparent good reason. On open wire work for telephone, telegraph or signal service, it is sufficient, but it is not enough for wires carrying six hundred volts or over. Fifteen (15) in. would be better for a minimum on such work. On the other hand there does not seem to be any reason for the compulsory installation of cable cross-arms. Where there are not more than two cables, it would be much better to attach them directly to one side of pole, and insist that they should be at least six (6) ft. from any wires or cables carrying more than six hundred volts of electricity.

Paragraph (c): This paragraph is ambiguous and is being interpreted in many ways. Primarily, it provides a minimum clearance of four (4) ft. between wires carrying more than six hundred volts of electricity and wires carrying less than six hundred volts, and then proceeds to modify this regulation for combination or joint construction. It does not limit distance to be maintained between wires of the same voltage, and in this respect permits dangerous construction to be maintained, notwithstanding its restrictions. It provides further, that in combination or joint construction; that is, where two or more companies, for the distribution of electric light and power, occupy the same poles, the high voltage wires shall be on one side of the pole and the low voltage wires on the other side of the pole provided, that a distance of three (3) ft. is maintained between high and low voltage wires in a horizontal line and provided, crossarms are three (3) ft. apart in a vertical line, that is, provided, high and low voltage wires are approximately forty-one (41) in. apart in a vertical line. It is a rather doubtful point as to whether it is compulsory for two or more companies, occupying the same poles, to place all their high voltage wires on one side of the pole and all the low voltage wires on the other side of the pole, adopting the clearances as above, or, it may be possible to adopt the straight four (4) ft. vertical clearance between wires, and still the doubt would exist as to the proper position for the high and low voltage wires. Again, construction may be installed by one party complying with the four (4) ft. regulation clearance and when a second party desires to combine on the same poles, the first party is compelled to reduce clearances and reconstruct under entirely different standards. Again, there is the doubt as to what constitutes a distributing company. According to this law, it is necessary to place all wires carrying more than six hundred volts on one side of the pole and all wires carrying less than six hundred volts on the other side of the pole wherever joint construction exists. According to this regulation, a company would be justified in believing that it should place its high voltage lines on crossarms on one side of a pole and possibly its telephone line on the same crossarm on the other side of the pole provided, the horizontal distance of three (3) ft. is maintained between such wires. This would represent possibly the worst type of construction that could be devised. Again, there is the difficulty of "buck-arming" or leading off from a circuit at corners or elsewhere. Exception is made for service wires which may be installed at any desired distance from wires of other voltages, yet when it is necessary to "buck," it is compulsory to maintain at least four (4) ft. between wires carrying more than six hundred volts and wires carrying less than six hundred volts. This throws the line arms at least eight (8) ft. apart and on combination work introduces almost an insurmountable condition at corners where even with high poles, cross leads are obstructed to an unnecessary degree. It should be permitted to maintain levels at corners by "buck-arming" with a minimum two (2) ft. clearance between wires. The same regulation should apply to service wires.

Paragraph (e): No insulation is desirable or necessary in guys attached to steel poles or towers which are thoroughly grounded. It is not necessary to space guys, attached to same pole, one (1) ft. apart, except when they are attached to the same anchorage.

Paragraph (h): This is a most useless provision in its present form. The high pole, short span construction is excellent, but can not be adopted except on narrow private rights of way or alleys, and as a standard, is not applicable generally. Double strength construction means nothing if existing construction

is inherently weak and defective. This paragraph should be amended to comply with Standard Crossing Specifications.

Paragraph (i): This could be eliminated from the law entirely, without affecting the efficiency of same. An examination of all the methods adopted to comply with this provision show that it has accomplished one thing only, that is, it has introduced extra elements or fixtures, any part of which is not stronger than the single bolt clamp commonly used heretofore. All side strains should be provided for in a much better manner than provided for in this law, but otherwise no additional parts should be introduced than those heretofore in use.

Section (3): No insulator is necessary in span between trolley wires. There is some question as to the correctness of the distance from pole at which span insulators are installed. As a protection to linemen, the present regulation is satisfactory. Some telephone companies would like to see the distance increased, so as to place the insulators at least five (5) ft. from pole.

Conclusions.

As it exists today, the law is a most incomplete specification covering overhead construction. There can be no doubt that it would be of mutual advantage to all concerned if the specifications of the National Electric Light Association were adopted in California as a standard instead of this law. These specifications have the approval not only of the National Electric Light Association, but also of the American Institute of Electrical Engineers, American Electric Railway Engineering Association, Association of Railway Telegraph Superintendents, and American Railway Engineering and Maintenance of Way Association, and it has been the result of many years of study of the various committees of these associations. In lieu of this, the law should be amended so as to be interpreted easily, and it would be well if drawings were prepared to supplement its general provisions. As long as it is on the statute books in its present form, it will lead to constant and continual misunderstandings. It is not reasonable to suppose that even the principal features of a satisfactory regulation could be provided in the few paragraphs covered by this law.

PROPOSED LAW ON OVERHEAD CONSTRUCTION.

(With changes as recommended by the Joint Pole Committee, Los Angeles, Cal.

An act regulating the placing, erection, use and maintenance of electric poles, wires, cables and appliances, and providing the punishment for the violation thereof.

Section 1. No commission, officer, agent or employe of the State of California, or of any city and county or city or county or other political subdivision thereof, and no other person, firm, or corporation shall

(a) Run, place, erect or maintain any wire or cable used to conduct or carry electricity, on any pole, or any crossarm, bracket or other appliance attached to such pole, within a distance of thirteen (13) in. from the center line of said pole; provided, that the foregoing provisions of this paragraph (a) shall be held not to apply to one or two telephone cables attached directly to one side of a pole and which are installed at least six (6) feet, at point of attachment, from any wire or cable carrying at any one time more than six hundred volts of electricity; and further provided, that the foregoing provisions shall be held not to apply to telephone, telegraph or other "signal" wires or cables which are attached to a pole to which is attached no wire or cable other than telephone, telegraph or other "signal" wire or cable, except within the corporate limits of any city or town which shall have been incorporated as a municipality, nor shall the foregoing provisions be held to apply to such wires or cables in cases where the same are run from underground and placed vertically on poles, nor to "bridle" or "jumper" wires on any pole which are attached to telephone, telegraph or other "signal" wires on the same pole, nor to any "aerial" cable, as between such cable and any pole on which it originates or terminates, nor to wires run from "lead" wires to arc lamps or to transformers placed upon poles, nor to any wire or cable where the same is attached to the top of a pole, as between it and the said pole, nor to any "aerial" cable containing telephone, telegraph or other "signal" wires where the same is attached to a pole on which no other wires or cables than wires continuing from said cable are maintained, provided, that electric light or power wires or cables are in no case maintained on the same side of the street or highway on which said "aerial" cable is placed.

(b) Run, place, erect or maintain in the vicinity of any pole (and unattached thereto) within the distance of thirteen (13) in. from the center line of said pole, any wire or cable used to conduct or carry electricity, or place, erect or maintain any pole (to which is attached any wire or cable used to conduct or carry electricity) within the distance of thirteen (13) in. (measured from the center of such pole) from any wire or cable used to conduct or carry electricity; provided, that as between any wire or cable and any pole as in this paragraph (b) named, only the wire, cable or pole last in point of time run, placed or erected, shall be held to be run, placed, erected or maintained in violation of the provisions of this paragraph; and further provided, that the foregoing provisions of this paragraph (b) shall be held not to apply to one or two telephone cables attached directly to one side of a pole and which are installed at least six (6) ft., at point of attachment, from any wire or cable carrying at any one time more than six hundred volts of electricity; and further provided, that this shall not be held to apply to telephone, telegraph or other "signal" wires or cables on poles to which are attached no other wires, as between such wires and poles to which are attached no other wires or cables than telephone, telegraph or other "signal" wires, provided such wires, cables and poles are not within the corporate limits of any town or city which shall have been incorporated as a municipality.

(c) Run, place, erect or maintain, above ground, within the distance of four (4) ft. from any wire or cable conducting or carrying less than six hundred volts of electricity, any wire or cable which shall conduct or carry at any one time more than six hundred volts of electricity, or run, place, erect or maintain within the distance of four (4) ft. from any wire or cable which shall conduct or carry at any one time more than six hundred volts of electricity any wire or cable conducting or carrying less than six hundred volts of electricity; and further provided, that wires or cables carrying more than six hundred volts of electricity may be placed on same crossarm with wires or cables carrying less than six hundred volts of electricity, if the space between any wire or cable carrying or conducting at any one time more than six hundred volts of electricity and any wire or cable carrying less than said voltage shall be at least three (3) ft. clear measurement in a horizontal line and four (4) ft. in a vertical direction; provided, that the foregoing provisions of this paragraph (c) shall be held not to apply to any wires or cables attached to a transformer, arc or incandescent lamp, within a distance of four (4) ft., (measured along the line of said wire or cable) from the point where such wire or cable is attached to such transformer, arc or incandescent lamp, nor to wires or cables within buildings or other structures, nor to wires or cables where the same are run from underground and placed vertically on poles, nor to any "lead" wires or cables between the point where the same are made to leave any pole for the purpose of entering any building

or other structure, and the point at which they are made to enter such building or structure, nor to any circuit installed for the purpose of leading off or "bucking" from a circuit where it is impracticable to maintain wires otherwise than in a level position; provided, however, that at all times a clearance of not less than two (2) ft. in a vertical direction at point of crossing is maintained between wires or cables carrying at any time more than six hundred volts of electricity and wires or cables carrying less than six hundred volts of electricity; and provided further, that as between any two wires or cables, or any wire or any cable run, placed, erected or maintained in violation of the provisions of this paragraph (c), only the wire or cable last in point of time run, placed or erected shall be held to run, placed, erected or maintained thus in violation of said provision.

(d) Run, place, erect or maintain, any wire or cable which shall conduct or carry at any one time more than six hundred volts of electricity, without causing each crossarm, or such other appliance as may be used in lieu thereof, to which such wire or cable is attached to be kept at all times printed a bright yellow color; or, on such crossarm, or other appliance used in lieu thereof, shall be placed enamelled iron signs, providing, in white letters on a green background, the words "High voltage," and these letters shall be not less than three (3) in. in height, said signs shall be securely fastened on the face and back of each crossarm. The provisions of this paragraph (d) shall not be held to apply to crossarms to which are attached wires or cables carrying or conducting more than ten thousand volts of electricity, and which are situated outside the corporate limits of any town or city which shall have been incorporated as a municipality.

(e) Run, place, erect or maintain any "guy" wire or "guy" cable attached to any pole or appliance to which is attached any wire or cable used to conduct or carry electricity, without causing said "guy" wire or "guy" cable to be effectively insulated at all times at a distance of not less than four (4) feet nor more than eight (8) ft. (measured along the line of said wire or cable) from the upper end thereof, and at a point not less than eight (8) ft. vertically above the ground from the lower end thereof; and further provided, that wherever two or more "guy" wires or "guy" cables are attached to same pole and same anchorage, there shall be at least one (1) ft. vertical space, between the points of attachment; and further provided, that no insulation shall be required at the lower end of a "guy" wire or "guy" cable where the same is attached to a grounded anchor; and further provided, that where guy is attached to a pole or structure of steel or other conducting material, which is thoroughly grounded, no insulation shall be required at any point in said guy; none of the provisions of this paragraph (e) shall be held to apply to "guy" wires or "guy" cables attached to poles carrying no wire or cable other than telephone, telegraph or other "signal" wire or cable, and which are situated outside the corporate limits of any town or city which shall have been incorporated as a municipality.

(f) Run, place, erect or maintain, vertically on any pole, any wire or cable used to conduct or carry electricity, without causing such wire or cable to be at all times wholly encased in casing equal in durability and insulating efficiency to a wooded casing not less than one and one-half (1½) in. thick. The provisions of this paragraph (f) shall not be held to apply to vertical telephone, telegraph or other "signal" wires or cables on poles where no other than such wires or cables are maintained, and which are outside the corporate limits of any town or city which shall have been incorporated as a municipality.

(g) Place, erect or maintain on any pole, or on any crossarm or other appliance on said pole, which carries or upon which is placed an electric arc lamp, any transformer for transforming electric currents.

(h) Run, place, erect or maintain any wire or cable carrying more than fifteen thousand volts of electricity across any wire or cable carrying less than said voltage or across any public highway, railroad right of way, track or line, except on poles which provide at least thirty (30) ft. head room between wire and highway or railroad track, and at least eight (8) ft. clearance above any existing wires under the most unfavorable conditions of temperature and loading; and provided further, that the crossing and adjacent poles shall be guyed thoroughly in all directions of strain, if practicable; and provided further, that the crossing and two adjoining spans shall be erected with the following factors of safety; wires and cables, two (2); pins, two (2); insulators, conductor attachments and guys, three (3); wooden poles and crossarms, eight (8); structural steel, three (3); re-enforced concrete poles, three (3); foundations, two (2); and provided further, that all insulators used on crossing and adjoining spans shall be capable of withstanding a dry flash-over test of three times the normal line voltage for a period of at least five consecutive minutes; and provided further, that the crossing and two adjoining spans shall be constructed so as to be self-supporting in every respect so that failure of any one member will not throw any excessive strain on any other part of the structure; and provided, that where pins are used, they shall be of steel and shall be electrically connected to ground, and that where wooden cross arms are used they shall be provided with a metallic plate on top of same equivalent in conductivity to line conductor; and provided further, that this plate shall be electrically connected to ground, and that all connections to ground shall not be less than the equivalent of number four (4) B and S copper wire.

Section 2. None of the provisions of the preceding section shall be held to apply to "direct current" electric wires or cables having the same polarity, nor to "signal" wires when no more than two (2) of such "signal" wires are attached to any one pole, provided, that none of such "direct current" or "signal" wires shall in any case be run, placed, erected or maintained within the distance of thirteen (13) in. from the center line of any pole (other than the pole or poles on which said wires or cables are carried) carrying electric wires or cables; and provided further, that as between any two wires or cables, or any wire or cable run, placed, erected or maintained in violation of the provisions of this section (2) only the wire or cable last in point of time run, placed, erected or maintained shall be held to be run, placed, erected or maintained thus in violation of said provisions.

Section 3. No commission, officer, agent or employe of the State of California, or of any city and county or city or county or other political subdivision thereof, and no other person, firm or corporation shall run, place, erect or maintain any "span" wire attached to any wire or cable used to conduct or carry electricity, without causing said "span" wire to be at all times effectively insulated between the outer point at which it is in any case fastened to the pole or other structure by which it is hung or supported, and at the point at which it is in any case thus attached, provided, that such insulation shall not in any case be placed less than two (2) ft. nor more than four (4) ft. from said point at which said "span" wire is so attached.

Section 4. Any violation of any provision of this act shall be deemed to be a misdemeanor, and shall be punishable upon conviction by a fine of not exceeding five hundred dollars ($500) or by imprisonment in a county jail not exceeding six (6) months or by both such fine and imprisonment.

Section 5. All acts or parts of acts which are in conflict with the, or with any of the provisions of this act, are hereby repealed.

Section 6. This act shall take effect six (6) months from the date of its passage in so far as it relates to new work, and a period of five (5) years shall be allowed in which to reconstruct all existing work and construction to comply with the provisions of this act.

SPECIFICATIONS FOR OVERHEAD CROSSINGS OF ELECTRIC LIGHT AND POWER LINES.[1]

General Requirements.

1. Scope: These specifications shall apply to overhead electric light and power line crossings (except trolley contact wires), over railroad right-of-way, tracks, or lines of wires; and, further, these specifications shall apply to overhead electric light and power wires of over 5000 volts constant potential, crossing, or constructed over telephone, telegraph or other similar lines.

2. Location: The poles, or towers, supporting the crossing span preferably shall be outside the railroad company's right-of-way.

3. Unusually long crossing spans shall be avoided wherever practicable.

4. The poles, or towers, shall be located as far as practicable from inflammable material or structures.

5. The poles, or towers, supporting the crossing span, and the adjoining span on each side, preferably shall be in a straight line.

6. The wires, or cables, shall cross over telegraph, telephone, and similar wires wherever practicable.

7. Cradles, or overhead bridges, shall not be used.

8. Clearance: The side clearance shall be not less than twelve ft. (12′ 0″) from the nearest rail of main line track, nor less than 6 ft. (6′ 0″) from the nearest rail of sidings. At loading sidings sufficient space shall be left for a driveway.

9. The clear headroom shall be not less than thirty ft. (30′ 0″) above the top of rail under the most unfavorable condition of temperature and loading. For constant potential, direct current circuits, not exceeding 750 volts, when paralleled by trolley contact wires, the clear headroom need not exceed twenty-five ft. (25′ 0″).

10. The clearance of alternating current circuits above any existing wires, under the most unfavorable condition of temperature and loading, shall be not less than eight ft. (8′ 0″) wherever possible. For constant potential, direct current circuits, not exceeding 750 volts, the minimum clearance above telegraph, telephone and similar wires may be two ft. (2′ 0″) with insulated wires and four ft. (4′ 0″) with bare wires.

11. The separation of conductors carrying alternating current, supported by pin insulators, for spans not exceeding 150 ft., shall be not less than:

Line Voltage.	Separation.
Not exceeding 6,600 volts	14½ inches
Exceeding 6,600 but not exceeding 14,000	24 inches
Exceeding 14,000 but not exceeding 27,000	30 inches
Exceeding 27,000 but not exceeding 35,000	36 inches
Exceeding 35,000 but not exceeding 47,000	45 inches
Exceeding 47,000 but not exceeding 70,000	60 inches

For spans exceeding 150 feet the pin spacing should be increased, depending upon the length of the span and the sag of the conductors.

Note: This requirement does not apply to wires of the same phase or polarity between which there is no difference of potential.

With constant potential, direct current circuits not exceeding 750 volts, the minimum spacing shall be ten in. (0′ 10″).

[1]Compiled by Joint Committee of National Electric Light Assn, American Institute of Electrical Engineers, American Electrical Railway Assn, Assoc. Railway Tel. Supts, Am. Ry., Eng. & Main. of Way Assn.

12. When supported by insulators of the disc or suspension type, the crossing span and the next adjoining spans shall be dead ended at the poles, or towers, supporting the crossing span, so that at these poles, or towers, the insulators shall be used as strain insulators.

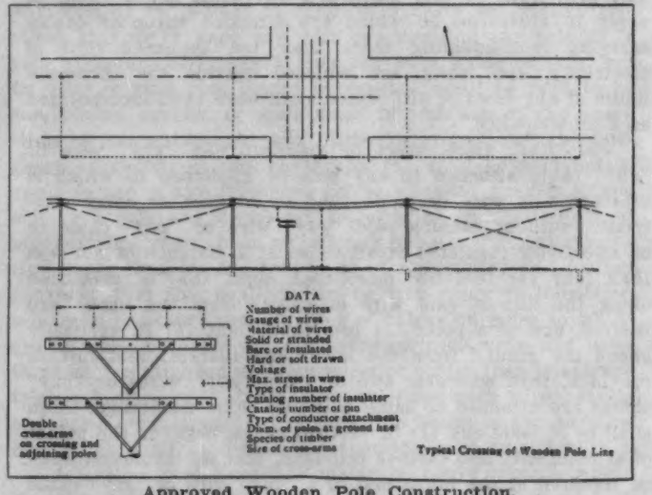
13. The clearance in any direction between the conductors nearest the pole, or tower, and the pole, or tower, shall be not less than:

Line Voltage.	Clearances.
Not exceeding 14,000 volts	9 inches
Exceeding 14,000 but not exceeding 27,000	15 inches
Exceeding 27,000 but not exceeding 35,000	18 inches
Exceeding 35,000 but not exceeding 47,000	21 inches
Exceeding 47,000 but not exceeding 70,000	24 inches

14. Conductors: The normal mechanical tension in the conductors generally shall be the same in the crossing span and in the adjoining span on each side, and the difference in length of the crossing and adjoining spans generally shall be not more than fifty per cent of the length of the crossing span.

15. The conductors shall not be spliced in the crossing span nor in the adjoining span on either side.

16. The method of supporting the conductors at the poles, or towers, shall be such as to hold the wires, under maximum loading, to the supporting



Approved Wooden Pole Construction.

structure, in case of shattered insulators or wires broken or burned at an insulator, without allowing an amount of slip which would materially reduce the clearance specified in paragraphs No. 9 and No. 10.

17.—Guys: Wooden poles supporting the crossing span shall be side-guyed in both directions, if practicable, and be head-guyed away from the crossing span. The next adjoining poles shall be head-guyed in both directions. Braces may be used instead of guys.

18. Strain insulators shall be used in guys from wooden poles carrying any power wire of less than 6600 volts. Strain insulators shall not be used in guying steel structures, nor required on wooden poles carrying wires all of which are 6600 volts or more.

19. Clearing: The space around the poles or towers shall be kept free from inflammable material, underbrush and grass.

20. Signs: In the case of railroad crossings, if required by the railroad company, warning signs of an approved design shall be placed on all poles and towers located on the railroad company's right-of-way.

21. Grounding: For voltages over 5000 volts, wooden crossarms, if used, shall be provided with a grounded metallic plate on top of the arm, which shall be not less than one-eighth inch (⅛") in thickness and which shall have a sectional area and conductivity not less than that of the line conductor. Metal pins shall be electrically connected to this ground. Metal poles and metal arms on wooden poles shall be grounded.

22. The electrical conductivity of the ground conductor shall be adjusted to the short-circuit current capacity of the system and shall be not less than that of a No. 4 B. & S. gauge copper wire.

23. Temperature: In the computation of stresses and clearances, and in erection, provision shall be made for a variation in temperature from —29 degrees Fahrenheit to +120 degrees Fahrenheit. A suitable modification in the temperature requirements shall be made for regions in which the above limits would not fairly represent the extreme range of temperature.

24. Inspection: If required by contract, all material and workmanship shall be subject to the inspection of the company crossed; provided that reasonable notice of the intention to make shop inspection shall be given by such company. Defective material shall be rejected, and shall be removed and replaced with suitable material.

25. On the completion of the work, all false work, plant and rubbish, incident to the construction, shall be removed promptly and the site left unobstructed and clean.

26. Drawings: If required, by contract, ... ( ) complete sets of general and detail drawings shall be furnished for approval, before any construction is commenced.

Loads.

27. The conductors shall be considered as uniformly loaded throughout their length, with a load equal to the resultant of the dead load plus the weight of a layer of ice one-half inch (½") in thickness, and a wind pressure of 8.0 lb. per square foot on the ice-covered diameter, at a temperature of 0 degrees Fahrenheit.

28. The weight of ice shall be assumed as 57 lb. per cu. ft. (0.033 lb. per cu. in).

29. Insulators, pins and conductor attachments shall be designed to withstand, with the designated factor of safety, the tension in the conductors under the maximum loading.

30. The pole, or towers, shall be designed to withstand, with the designated factor of safety, the combined stresses from their own weight, the wind pressure on the pole, or tower, and the above wire loading on the crossing span and the next adjoining span on each side. The wind pressure on the poles, or towers, shall be assumed at 13 lb. per square foot on the projected area of solid or closed structures, and on one and one-half (1½) times the projected area of latticed structures.

31. The poles, or towers, shall also be designed to withstand the loads specified in paragraph No. 30, combined with the unbalanced tension of:

2 broken wires for poles, or towers, carrying 5 wires or less
3 broken wires for poles, or towers, carrying 6 to 10 wires
4 broken wires for poles, or towers, carrying 11 or more wires

32. Crossarms shall be designed to withstand the loading specified in paragraph No. 30, combined with the unbalanced tension of one wire broken at the farthest from the pole.

33. The poles, or towers, may be permitted a reasonable deflection under the specified loading, provided that such deflection does not reduce the clearances specified in paragraph No. 10 more than 25 per cent or produce stresses in excess of those specified in paragraphs Nos. 65 to 69.

Factors of Safety.

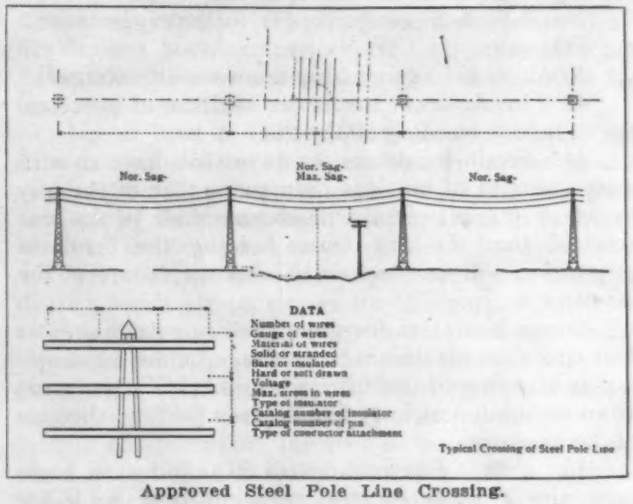
34. The ultimate unit stress divided by the allowable unit stress shall be not less than the following:

Wires and cables	2
Pins	2
Insulators, conductor attachments, guys	3
Wooden poles and crossarms	6
Structural steel	3
Reinforced concrete poles and crossarms	4
Foundations	2

Note.—The use of treated wooden poles and crossarms is recommended. The treatment of wooden poles and crossarms should be by thorough impregnation with preservative by either closed or open-tank process. For poles, except in the case of yellow pine, the treatment need not extend higher than a point two feet above the ground line.

35. Insulators: Insulators for line voltages of less than 9000 shall not flash over at four times the normal working voltage, under a precipitation of water of one-fifth of an in. (1/5") per min., at an inclination of 45 degrees to the axis of the insulator.

36. Each separate part of a built-up insulator, for line voltages over 9000, shall be subjected to the dry flash-over test of that part for five (5) consecutive minutes.



Approved Steel Pole Line Crossing.

37. Each assembled and cemented insulator shall be subjected to its dry flash-over test for five (5) consecutive minutes.

The dry flash-over test shall be not less than:

Line Voltage.	Test Voltage.
Exceeding 9,000 but not exceeding 14,000	65,000
Exceeding 14,000 but not exceeding 27,000	100,000
Exceeding 27,000 but not exceeding 35,000	125,000
Exceeding 35,000 but not exceeding 47,000	150,000
Exceeding 47,000 but not exceeding 60,000	180,000
Exceeding 60,000	3 times line voltage

Each insulator shall further be so designed that, with excessive potential, failure will first occur by flash-over and not by puncture.

38. Each assembled insulator shall be subjected to a wet flash-over test, under a precipitation of water of one-fifth of an in. (1/5") per min., at an inclination of forty-five degrees (45°) to the axis of the insulator.

The wet flash-over test shall be not less than:

Line Voltage.	Test Voltage.
Exceeding 9,000 but not exceeding 14,000	40,000
Exceeding 14,000 but not exceeding 27,000	60,000
Exceeding 27,000 but not exceeding 35,000	80,000
Exceeding 35,000 but not exceeding 47,000	100,000
Exceeding 47,000 but not exceeding 60,000	120,000
Exceeding 60,000	twice the line voltage

39. Test voltages above 35,000 volts shall be determined by the A. I. E. E. Standard Spark-Gap Method.

40. Test voltages below 35,000 volts shall be determined by transformer ratio.

Material.

41. Conductors: The conductors shall be of copper, aluminum, or other non-corrodible material, except that in exceptionally long spans, where the required mechanical strength cannot be obtained with the above materials, galvanized or copper-covered steel strand may be used.

42. For voltages not exceeding 750 volts, solid or stranded conductors may be used up to and including 4/0 in size; above 4/0 in size, stranded conductors shall be used. For voltages exceeding 750 volts, and not exceeding 5000 volts, solid or stranded conductors may be used up to and including 2/0 in size; above 2/0 in size, conductors shall be stranded. For voltages exceeding 5000 volts, all conductors shall be stranded. Aluminum conductors for all voltages and sizes shall be stranded.

The minimum size of conductors shall be as follows:

No. 6 B. & S. gauge copper for voltages not exceeding 5000 volts.

No. 4 B. & S. gauge copper for voltages exceeding 5000 volts.

No. 1 B. & S. gauge aluminum for all voltages.

43. Insulators: Insulators shall be of porcelain for voltages exceeding 5000 volts.

44. Strain insulators for guys shall have an ultimate strength of not less than twice that of the guy in which placed. Strain insulators shall be so constructed that the guy wires holding the insulator in position will interlock in case of the failure of the insulator.

Strain insulators for guys shall not flash over at four times the maximum line voltage, under a precipitation of water of one-fifth of an in. (1/5") per min., at an inclination of forty-five degrees (45°) to the axis of the insulator.

45. Pins: For voltages of 5000 and over, insulator pins shall be of steel, wrought iron, malleable iron, or other approved metal or alloy, and shall be galvanized, or otherwise protected from corrosion.

46. Guys: Guys shall be galvanized or copper-covered stranded steel cable, not less than 5/16 in. in diameter, or galvanized rolled rods of equivalent tensile strength.

47. Guys to the ground shall connect to a galvanized anchor rod, extending at least one foot above the ground level.

48. The detail of the anchorage shall be definitely shown upon the plans.

49. Wooden Poles: Wooden poles shall be of selected timber, peeled, free from defects which would decrease their strength or durability, not less than seven (7) in. minimum diameter at the top, and meeting the requirements as specified in paragraphs 17, 30, 31 and 34.

50. Concrete: All concrete and concrete material shall be in accordance with the requirements of the Report of the Joint Committee on Concrete and Reinforced Concrete.

Structural Steel.

51. Structural steel shall be in accordance with the Manufacturers' Standard Specifications.

52. The design and workmanship shall be strictly in accordance with first class practice.

53. The form of the frame shall be such that the stresses may be computed with reasonable accuracy, or the strength shall be determined by actual test.

54. The sections used shall permit inspection, cleaning and painting, and shall be free from pockets in which water or dirt can collect.

55. The length of a main compression member shall not exceed 180 times its least radius of gyration. The length of a secondary compression member shall not exceed 220 times its least radius of gyration.

56. The minimum thickness of metal in galvanized structures shall be one-quarter in. (¼") for main members and one-eighth in. (⅛") for secondary members. The minimum thickness of painted material shall be one-quarter in. (¼").

Protective Coatings.

57. All structural steel shall be thoroughly cleaned at the shop and be galvanized, or given one coat of approved paint.

58. Painted Material: All contact surfaces shall be given one (1) coat of paint before assembling.

All painted structural steel shall be given two (2) field coats of an approved paint.

The surface of the metal shall be thoroughly cleaned of all dirt, grease, scale, etc., before painting, and no painting shall be done in freezing or rainy weather.

59. Galvanized Material: Galvanized material shall be in accordance with the Specifications for Galvanizing Iron and Steel.

Bolt holes in galvanized material shall be made before galvanizing.

Foundations.

60. The foundations for steel poles and towers shall be designed to prevent overturning.

The weight of concrete shall be assumed as 140 lb. per cubic foot. In good ground, the weight of "earth" (calculated at 30 degrees from the vertical) shall be assumed as 100 lb. per cubic foot. In swampy ground, special measures shall be taken to prevent uplift of depression.

61. The top of the concrete foundation, or casing, shall be not less than 6 in. (6") above the surface of the ground, nor less than one foot (1') above extreme high water.

62. When located in swampy ground, wooden crossing and next adjoining poles shall be set in barrels of broken stone or gravel, or in broken stone or timber footings.

63. When located in the sides of banks, or when subject to washouts, foundations shall be given additional depth, or be protected by cribbing or riprap.

64. All foundations and pole settings shall be tamped in six-inch (6") layers, while back filling.

Working Unit Stresses.

Obtained by dividing the ultimate breaking strength by the factors of safety given in paragraph No. 34.

65. STRUCTURAL STEEL.

Tension (net section)	18,000	lbs. per sq. in.
Shear	14,000	lbs. per sq. in.
Compression	$18{,}000\text{-}60\frac{l}{r}$	lbs. per sq. in.

66. RIVETS, PINS.

Shear	10,000	lbs. per sq. in.
Bearing	20,000	lbs. per sq. in.
Bending	20,000	lbs. per sq. in.

67. BOLTS.

Shear	8,500	lbs. per sq. in.
Bearing	17,000	lbs. per sq. in.
Bending	17,000	lbs. per sq. in.

68. WIRES AND CABLES.

Copper, hard-drawn, solid, B. & S. gauge, 4/0, 3/0, 2/0	25,000 lbs. per sq. in.
Copper, hard-drawn, solid, B. & S. gauge, 1/0	27,500 lbs. per sq. in.
Copper, hard-drawn, solid, B. & S. gauge, No. 1	28,500 lbs. per sq. in.
Copper, hard drawn, solid, B. & S. gauge, No. 2, 4, 6	30,000 lbs. per sq. in.
Copper, soft-drawn, solid, B. & S.	17,000 lbs. per sq. in.
Copper, hard-drawn, stranded, B. & S.	30,000 lbs. per sq. in.
Copper, soft-drawn, stranded, B. & S.	17,000 lbs. per sq. in.
Aluminum, hard-dr'n, stranded, B. & S. gauge under 4/0	12,000 lbs. per sq. in.
Aluminum, hard-dr'n, stranded, B. & S. gauge, 4/0 & over	11,500 lbs. per sq. in.

69. UNTREATED LUMBER.

	Bending.	Compression. $\frac{L}{40D}$
Eastern white cedar	600 lbs. per sq. in.	$600\left(1-\frac{L}{40D}\right)$
Chestnut	850 lbs. per sq. in.	850 "
Washington cedar	850 lbs. per sq. in.	850 "
Idaho cedar	850 lbs. per sq. in.	850 "
Port Orford cedar	1150 lbs. per sq. in.	1150 "
Long-leaf yellopw pine	1100 lbs. per sq. in.	1100 "
Short-leaf yellow pine	950 lbs. per sq. in.	950 "
Douglas fir	1000 lbs. per sq. in.	1000 "
White oak	950 lbs. per sq. in.	950 "
Red cedar	700 lbs. per sq. in.	700 "
Bald cypress (heartwood)	800 lbs. per sq. in.	800 "
Redwood	850 lbs. per sq. in.	850 "
Catalpa	500 lbs. per sq. in.	500 "
Juniper	550 lbs. per sq. in.	550 "

L = Length in inches.
D = Least side, or diameter, in inches.

PACIFIC COAST GAS ASSOCIATION.

An appeal is being made to the members of the Pacific Coast Gas Association by John A. Britton, secretary, to increase the present membership from 380 to 500 by the time of the annual convention in San Diego. The convention is to be held September 17, 18 and 19, and from present indications the program being prepared will be among the most profitable and interesting in the history of the association.

WESTERN GOVERNORS OPPOSE CONSERVATION POLICY.

Declaring for state rights and against the conservation policy as now fastened upon the Western states by Federal department heads through their rules, regulations and construction of laws passed with the object of helping settlers, Governor Norris of Montana opened the first annual session of the conference of Western Governors at Boise last week.

The surprise of the opening day's conference was a proposal made by Delos A. Chappell, of Denver, personal representative of Governor Shafroth of Colorado, a big electrical power developer of that state, that the conference of Western Governors and the public lands convention join hands in making the fight for relief from the iron-clad and restrictive rules of the Federal department heads, who are claimed to be Nationalists, and to install a publicity department at Washington for the purpose of having proper relief legislation enacted and the speeches of members of both houses on this measure printed in the records, so they can be distributed among the people for educational purposes along this line. The proposal called for a lively and heated discussion.

Definite action was postponed until later.

In his address, Govenor Norris made a plea for state rights, that the Western people are devoted to the interests of the Nation and of the other states, but feel they may properly exert their best efforts to protect and favor such interests as are of right their own.

"There is a Western theory that all benefits from National resources of right belong to the people of the state wherein the same are situated," said Governor Norris. "The benefits that will be derived will be far greater by the adoption of the Western theory. The first duty of the states is to adopt a policy that is fair and just, and then they may rightfully appeal to Congress to turn over to them the administration of the lands and natural resources belonging to the general Government."

OUTCOME OF WASHINGTON STATE COMPENSATION ACT.

Much interest attaches to the actual working of the Compensation Act of the State of Washington. This act went into effect about a year ago and its principal clauses were commented upon editorially in these columns at the time. The Pacific Builder and Engineer has compiled the following statistics on the operation of this law during the past year:

Workmen's Compensation Act of Washington, after eight months of practical administration, has brought 5200 employers and 125,000 employes under the law.

The expenses have been heavy during these several months, yet this only amounts to 11 per cent of the total funds handled. This includes the expense of office fixtures, books, stationery, etc. All expenses of administering the law are paid by the state and not by the listed industries.

Up to June 1, 1912, approximately $700,000 had been contributed by the hazardous industries to the accident fund and approximately $377,000 has been paid out by the commission to injured men in cash and invested in bonds to insure pensions to workmen's widows and orphans. Municipal, county and school district bonds are purchased for this purpose, thereby retaining large sums of money in the state, that would otherwise largely pass to the east through casualty companies. In this connection it has been shown that, notwithstanding the amount of money paid to workmen in compensation, the cost to employers in many cases is less than casualty insurance. This is illustrated by class 10, lumber mills and loggers, where the cost last year for casualty insurance was $1.35 to $1.50 per thousand. So far it has cast the employers under the Compensation Act but 62½ cents per thousand.

Out of 5200 employers subject to the law only 33 have failed to pay on demand, and of these 14 cases have been settled by the attorney-general's office. Of the remaining 19 many are in process of adjustment. Very few of those in default have shown any intention of going into court. Out of 5666 claims passed upon but 12 appeals have been filed.

There is a decided move on to have a first aid clause added to the act. This is due to the fact that at present costs of necessary medical, surgical and hospital service are added to the claimant's wage-loss.

LECTURE ON ILLUMINATION.

W. D'A. Ryan, illuminating engineer with the General Electric Company, will give a lecture on "The History of Illumination," in the colonial ballroom of the St. Francis Hotel, San Francisco, at 8 o'clock on Friday evening, August 16. All electrical men are invited to attend.

WESTERN LAWS OF ELECTRICITY AND WATER

IRRIGATION DISTRICTS.

BY A. E. CHANDLER.

Legislation for the formation of districts for flood protection, drainage and roads was long ago adopted in both the Eastern and Western states. Such acts secure for a community the benefits of protective or public improvement works through taxation, even though a minority of the property holders object. As the appreciation of the results of irrigation in the interior valleys of California spread during the eighties and as the obstacle in the way of community enterprises of the old partnership or ordinary corporation type seemed to be the larger ranchers who opposed the movement, the compulsory district organization was suggested. The first irrigation district act was adopted by the California legislature in 1887 and has since been generally known as the Wright Act, as State Senator C. C. Wright was the most prominent champion of the measure.

The California Irrigation District Act.

The California irrigation district act as amended and supplemented, was re-enacted in 1897 and is locally known as the Bridgford Act. Statutes very closely following those of California have been adopted in every irrigation state with the exception of Arizona (bill pending in legislature May 1, 1912), the Dakotas and Oklahoma.

The following presentation of the provisions of the irrigation district act is for the Bridgford Act of California, but it will serve as a general statement for such legislation in the other states as the points of difference are but few.

An irrigation district is initiated by a petition to the Board of Supervisors signed by "a majority in number of the holders of title to lands susceptible of irrigation from the proposed source and representing a majority in value of said lands." The petition must be published for two weeks and be presented at a regular meeting of the board, at which time a hearing is given to all those interested. If the action of the board is favorable it defines the boundaries and divides the proposed district into three or five divisions. Any party aggrieved by the action of the board may appeal to the Superior Court.

After favorable action by the board a date is set for an election on district organization, the notice for which must be published for three weeks. All qualified electors within the district may vote upon the organization and at the same time vote for the three or five directors, an assessor, a tax collector, and a treasurer. Two-thirds of all votes cast must be for the formation of the district in order to carry it. If the vote be favorable the board of directors so elected has control of the district business, causes surveys and plans of the irrigation system to be made and, after petition so to do, causes a bond election to be held. At this election a majority of the votes cast is necessary to carry the bond issue. The bonds bear interest at the rate of five per cent, are payable from the twenty-first to the thirtieth year and must be sold at not less than par.

The interest on the bonds and the operation and maintenance expenses of the district are paid by taxing all lands within the district on an ad valorem basis. The act specifically provides for the sale of property for non-payment of taxes as in the case of non-payment of state or county taxes.

Several amendments to the district act were passed at the regular and special sessions of the California legislature in 1911. The aim of all of the amendments was to secure a better financial basis for the sale of the district bonds. The principal act provides for a detailed examination of the feasibility of the districts by a commission, composed of the Attorney General, the State Engineer and the Superintendent of Banks, when called upon to do so by the district board of directors. When the commission approves the feasibility of any district project, the bonds of the district may be registered at the office of the State Controller and thereupon shall be considered legal investments for all trust funds and for funds of insurance companies, banks, etc., and are in general placed upon the same legal basis for purposes of investment as the bonds of cities and counties, school districts, or municipalities.

Points of Difference in Irrigation District Acts.

The principal points of difference in the various state statutes providing for irrigation districts are the provisions regarding state supervision; the exclusion of land included in the original petition; the qualifications of voters; the rate of interest on bonds and the authority to sell bonds below par; and the basis of assessment.

In Idaho, Oregon and Wyoming, the feasibility of the project must be approved by the state engineer. The operations under the acts in Oregon and Wyoming are just beginning but a number of districts have been operated successfully for many years in Idaho. In the latter state the original petition to the board of county commissioners must be accompanied by a map of the proposed district. The petition and map are referred to the state engineer for report and if his report be against the organization of the district the county commissioners must refuse to further consider the petition unless it be requested in writing so to do by three-fourths of the landowners in said proposed district. The plans and specifications for the proposed system prepared after the formation of the district, must also be reported upon by the state engineer, but it is not provided that such plans must be changed in order to secure his approval.

In the California act it is provided that the board of supervisors shall not allow to be included in the proposed district any lands which will not, in its judgment, be benefitted by the proposed means of irrigation. This provision is the general one, but in Wyoming it is provided, "nor shall any land be included in

such district if the owner thereof shall make application at such hearing to withdraw the same." In Oregon no land can be included in the district which lies within the limits of any city or town. In Colorado and Wyoming it is provided that no land shall be taxed for irrigation purposes "which from any natural cause cannot be irrigated, or is incapable of cultivation."

In California any elector residing within the district has the right to vote regardless of property qualifications—it being generally understood that to place limitations upon the right to vote would render the section unconstitutional. In Colorado and Idaho the voters must be resident freeholders, and the Oregon statute provides that a bona fide owner of land, whether a resident or not, may vote.

The rate of bond interest varies from five per cent in California to seven per cent in Idaho, and a number of states allow bonds to be sold at not less than ninety per cent of par value.

The basis for assesssment in California is the full cash value of the property. In Idaho the assessment is made in accordance with the benefits received as determined by the board of directors. In Colorado and Wyoming all lands within the district for the purposes of taxation must be valued by the assessor at the same rate per acre. This last method is analogous to that used by the ordinary irrigation companies in charging a fixed rate per acre.

The Constitutionality of Irrigation District Acts.

Owing to the compulsory nature of the irrigation district enterprise, it was to be expected that litigation should be initiated immediately after the formation of the first California districts by the landowners whose lands had been included against their wish. The validity of the act was assailed on every possible ground but was upheld by the Supreme Court of California and finally, in the celebrated case of Fallbrook Irrigation District v. Bradley (164 U. S. 112), by the Supreme Court of the United States. Extensive litigation has followed the inauguration of irrigation districts in other states but the validity of the several acts has likewise been upheld. There seems to be no question, therefore, that the many provisions of the irrigation district acts are legally sound.

The report of the case of Fallbrook Irrigation v. Bradley is interesting not only for the opinion by the court, but also for the argument against the validity of the act given by Joseph H. Choate, who in his argument presents the view of a great number of Californians at that time in regard to the questionable novel features of the act. The following extract from Mr. Choate's argument shows what he thought of the new system:

> This brings into view the unique and, as we believe, wholly unprecedented features of the scheme contrived by this act for the oppression of the farmers of California. We think that the statute books of all states and nations outside of California, prior to 1887, will be searched in vain, without finding another such example, and especially in view of the construction which has been given to certain details of this statute by the Supreme Court of California.

Operations Under Irrigation District Acts.

Although thirteen irrigation states have irrigation district acts, only eight had irrigation district enterprises irrigating land in 1909, and only nine had projects either completed or under construction in 1910. The following table taken from the advance sheets of the Thirteenth Census shows by states the acreage irrigated by irrigation district canals in 1909, and also the acreage included within districts completed or under construction in 1910.

State.	Acreage Irrigated in 1909, by Irrigation Districts.	Acreage Irrigation Districts were capable of irrigating in 1910.
California	173,793	606,351
Colorado	115,304	487,370
Idaho	140,930	329,796
Montana	4,912	15,040
Nebraska	76,448	91,076
Oregon	1,500	5,980
Utah	8,455	10,302
Wyoming	11,800	27,050

A glance at the above table shows that there has been little irrigation district development outside of California, Colorado, Idaho and Nebraska and that such development has been most pronounced in the three states first named.

Irrigation Districts in California.

The Irrigation Investigations of the United States Department of Agriculture has gathered data for the publication of a report on irrigation districts in California. Certain statistical information from the proposed report was presented in a paper read by Mr. Frank Adams, in charge in California, before the Commonwealth Club of California. On account of the growing interest in the history of California districts, the following long quotation is made from Mr. Adams' paper:

> Forty-nine districts were organized, and of these only 25 ever issued any bonds.
>
> The statement that practically all of the 49 defaulted in large amounts should therefore be reduced one-half.
>
> Of the 24 districts that issued no bonds, none at this time has any outstanding indebtedness. Eleven have been legally dissolved. Twelve have not been dissolved, although they are not active. One, the Walnut Irrigation District, covering about 900 acres of land in Los Angeles County, near Whittier, has been active and successful from the date of its organization and has never defaulted in any way in payment of indebtedness.
>
> Of the 25 that issued bonds, 7 have made some kind of a settlement and have no outstanding obligations as districts at this time. Two have made settlement, but still have small outstanding indebtedness that either has been declared illegal or can not be found. Four have made settlement by exchanging new for old bonds and are now active, and with the exception of one, whose reorganization is not yet complete and which therefore cannot be judged, are active and successful and can undoubtedly be counted on to pay both bonds and interest as due. Five have compromise settlements pending. Seven have apparently been totally abandoned, with no plan of settlement as yet seriously taken up.
>
> Where settlements have been made they have been so different that it is hard to explain them with sufficient brevity for the purpose of this paper, and reference is therefore made to the table that will be submitted. The lowest basis of settlement has been 30 cents on the dollar, and the highest between 80 cents and 90 cents. Several compromised at 50 cents.
>
> Of the 7 districts that apparently have been totally abandoned, and for which no plans of settlement have yet been seriously taken up, at least 3 were wildcat land-promotion schemes, pure and simple, and although reported favorably by engineers of reputation, apparently never had engineering justification, chiefly due to lack of water. The outlook for them is not encouraging, although in time they will without question be cleared up in some way. This might also be said of the other four.

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CONTENTS

Electric Equipment of the Steamer "Thoroughfare" 107
By H. A. Russell.

Safeguarding the Children 108

Too Much Paint No Protection to Iron 108

Criticism of Present California Law on Overhead Construction 109

Specifications for Overhead Crossings of Electric Light and Power Lines 112

Pacific Coast Gas Association 115

Western Governors Oppose Conservation Policy 115

Outcome of Washington State Compensation Act 115

Lecture on Illumination 115

Irrigation Districts 116
By A. E. Chandler.

Editorial 118
A Conservation Committee.
Safeguarding the Children.
Proposed Law on Overhead Construction.

Personals 120

Jovian Lunch Club, San Francisco 120

Report of International Congress Committee 120

Methods of Estimating 121
By W. S. Hanbridge.

Trade Notes 122

New Catalogues 122

Industrial 123
Power Factor Meters.
Ozone and How It Improves Ventilation.
New Nelite Industrial Reflectors.

News Notes 125

A Conservation Committee

Representatives of the hydroelectric interests in California met recently for the purpose of selecting a committee to sit for these interests at a water power conference to be held at an early date. The session will be called by Secretary Fisher of the Department of the Interior. Representatives from the Geological Survey, the Forest Service, Department of Agriculture, the Bureau of Corporations, and the California Water Commission have also been invited to attend.

It is most opportune that such a meeting, composed of parties at issue in the present hydroelectric disputes should be called at this time. The commissioner of corporations, some time since, made a report to President Taft relative to the present ownership of water powers, developed and undeveloped, in the United States. California, of all Western states, is at present in the highest state of hydroelectric development. With but one single exception this state according to the commissioner's report presents the greatest future hydroelectric possibilities of any state in the union. With a possible minimum of 3,424,000 h.p. in total water power, and a present development of 435,467 h.p., California stands in the limelight as a state of utmost interest to those following affairs electrical.

The fact that eight large corporate interests or even one large corporate interest seems to control at present the hydroelectric power of the United States is not in itself a cause for alarm. Hydroelectric enterprises, commission controlled, may be made of utmost service to this generation and to the solution of our present economic problems without calling for one foot-pound of wasted energy in our national resources, for like the widow's cruse of oil, the eternal waterfall, used over and over again, blesses mankind with its store of light and warmth without the slightest lessening in supply. On the other hand, that loud-sounding cry of conservation which would put off to another age and generation powers so dearly needed in our present industrial era, leads but to stagnation in national industry and even possibly to a blighting in national growth in a new and promising community.

The alert and emphatic action of Western governors in convention assembled, an account of which is found elsewhere in these columns, bespeaks the spirit of the West. Hence the result of the forthcoming conference will be watched by all with the keenest interest.

Safeguarding the Children

The horrifying crushing of children under street cars, one in San Francisco and the other in Seattle, of late, has once again aroused public discussion as to means of prevention or at least the minimizing of such distressing accidents.

Much good can be accomplished by public safety committees in the various cities of the coast. First, an investigation as to how the accidents most frequently occur and then a widespread campaign of education among the children and parents emphasizing methods of accident prevention will do worlds of

good. In the East, the Philadelphia Rapid Transit Company deserves much credit for the efficient manner in which they have conducted their accident prevention crusade. On another page of this issue will be found a digest of the rules and warnings that have been formulated. These printed in attractive form have been distributed by the thousands to parents and children through the courtesy of the city board of education.

The influence of the home is the most powerful force that can be brought to bear upon the children. Co-operation between the parents, a permanent public safety committee, and the traction officials will in every case, we believe, reduce to a minimum such frightful accidents as above alluded to that happened recently in San Francisco in which a youngster strayed out into the middle of the street, became oblivious to its surroundings, only to be crushed to an unrecognizable mass a few minutes later almost within the sight of the mother.

It is an excellent discipline in life to be alert, to learn to heed warnings, to resist the temptation of examining fallen or dangling wires, to have patience until the car stops, to avoid dangerous places while roller skating. Such are some of the important findings in Philadelphia, and their shunning, we believe, will be found just as wholesome in effects in the West as in the East. Other factors peculiar to western habits and western life undoubtedly contribute to the loss of life and injury to the children of the West. It is to be hoped that our public spirited traction officials of the West will study out these problems with vim and vigor at once, not waiting for the demand to come from the public themselves. By such zealous, ever-active methods a wholesome grateful spirit is imbued in the hearts of the public that can be brought about in no other way.

Proposed Law on Overhead Construction

No one law affecting public utilities has seemingly brought about as much dissatisfaction and divergence of opinion in regard to carrying out its mandates as does the present California law on overhead crossings which went into effect some months back. By reading the list of some of the objections to this law, appearing on another page of this issue, and compiled by serious, earnest, engineering thinkers interested, no one can for a moment come to any other conclusion but that the present law is unjust, inconsistent, vague, and often meaningless.

Indeed, so convinced are those affected by this law that its present provisions are thoroughly inadequate and wholly misdirected, a state-wide protest has arisen to have the law properly amended. The provisions as to overhead crossings are so foolishly far from accomplishing a useful purpose that they might to one discussing lighter subjects, be technically termed "a joke."

The question of proper construction in overhead crossings is not an easy one of solution. So frequently does the march of progress and invention bring about better material and more safe methods of construction, it is doubtful if any law can be made to adequately express proper specifications for all time to come.

The whole subject is one that has attracted the profoundest attention of our largest and most learned technical societies. On another page of this issue is to be found the specifications for overhead crossings of electric light and power lines compiled by joint committees of the five great electrical societies of America—the National Electric Light Association, the American Institute of Electrical Engineers, the American Electric Railway Association, the Association of Railway Telegraph Superintendents, and the American Railway Engineering and Maintenance of Way Association.

Let us for a moment examine the new California Public Utilities Act. In Sec. 44, under the heading Investigation of Accidents, there appears the following mandate:

> "The commission shall investigate the cause of all accidents occurring within this state upon the property of any public utility or directly or indirectly arising from or connected with its maintenance or operation, resulting in loss of life or injury to person or property and requiring, in the judgment of the commission, investigation by it, and shall have power to make such order and recommendation thereto as in its judgment may seem just and reasonable."

We maintain that even though the public utility companies of California live up to the mandates of the law in question, even then, the commission may direct improvements and alterations as in their judgment are demanded for public safety to life and property. Indeed it is questionable whether this clause does not of itself repeal the law at issue, for under Sec. 87 of the Public Utilities Act, we find that "all acts or parts of acts inconsistent with the provisions of this act, are hereby repealed."

We would suggest, then, since a new law to amply express the provisions of overhead construction and other mandates involved in the present law, must of necessity be long and cumbersome, besprinkled with many illustrations; since these provisions, due to the march and progress of invention, are constantly changing; and, furthermore, since the present Railroad Commission, acting under the new Public Utilities Act, has authority to go even further than this act and, in fact, may even have complete authority in preference to the present law on overhead construction, that in order to settle all discussion and doubts in the matter a new law be framed in the nature of an amendment to the Public Utilities Act. The amendment may easily be brought about by properly substituting the word "public utility" for the word "railroad" in section six of Section 43 of the Public Utilities Act. In this manner, the commission will be given exclusive power to determine and prescribe the manner and the terms of installation, operation, maintenance, use and protection of each crossing of public utilities either over railroads or the public highways Of course such provisions may be added in this amendment that the rules laid down must conform as nearly as is practicable to the findings of the National engineering societies. Thus will easily be settled a question which at present involves much obscurity and at the same time an elasticity is given to take advantage of the march and progress of invention. On the other hand, since the commission is directed to cling as nearly as is reasonable to the specifications of the great national engineering societies, the public utility companies are protected from the possible whim and caprice of a future regulating commission.

PERSONALS.

C. L. Cory recently returned to San Francisco from Spokane, Wash.

Walter Trent, head of the Trent Engineering Company, of Reno, is a San Francisco visitor.

E. H. Grange, an electrical contractor of Upland, is among the recent arrivals at San Francisco.

Leon M. Hall who is engineer for several new hydroelectric projects, spent the past week at Virginia City, Nev.

J. B. Lukes, of the Stone & Webster Construction Company's San Francisco office, visited Reno during the week.

J. B. Lippincott, hydraulic engineer on the Los Angeles Aqueduct, recently visited at San Francisco from the South.

Cyrus Peirce, San Francisco manager for N. W. Halsey & Co., who are extensive holders of California electrical securities, returned during the week from an extensive automomobile tour after enjoying the fishing in Northern California.

Elmer Dover, president of the Tacoma Gas Company, of Tacoma, Wash., was at San Francisco during the past week, conferring with C. E. Groesbeck of H. M. Byllesby & Company.

R. L. Van der Naillen, general manager of the Oro Electric Corporation, recently returned to San Francisco, after visiting the power site of the company's proposed hydroelectric development on Yellow Creek.

F. A. Richards, manager of the railway department of Pierson, Roeding & Company, is at Vancouver, B. C., on business.

F. O. Broili, manager of the Nevada Machinery and Electric Company, of Reno, Nev., is a recent San Francisco visitor.

F. Emerson Hoar is now connected with the California Railroad Commission as an electrical expert, specializing on rate matters.

J. S. Baker, district manager for the Crocker-Wheeler Company, is again at his office, after having been confined to his home by illness.

E. B. Bumstead, of the Pacific Coast engineering staff, left last Wednesday on an Eastern trip for the Stone & Webster Engineering Corporation.

H. A. Hinshaw, assistant general manager of the Salem, Falls City & Western Railroad, which extends between Dallas and Falls City, Oregon, is a San Francisco visitor.

Harry H. Daley, sales engineer with the Westinghouse Electric and Manufacturing Company's San Francisco office, was an interested spectator at the Salinas "rodeo."

A. W. Bullard, vice-president of the Great Western Power Company, has returned to San Francisco after an inspection of the work in progress on the Big Meadows dam.

C. E. S. Forney, who is interested in a combination of gas companies covering Hanford, Lemoore and various San Joaquin Valley towns, was a recent San Francisco visitor.

J. Tachihara, an official of the Mitsu Bishi Dockyard and Engine Works at Kobe, Japan, has been visiting electric power and engineering plants at San Francisco and near-by points.

G. D. Sherwood, who has extensive electric power and water works interests at Spokane, Wash., was at San Francisco during the week and later went to the Bohemian Grove to witness the jinks.

F. E. Vickers of the engineering department of the General Electric Company's San Francisco office, has been appointed turbine inspector for the district. **John Hood** is now the company's local engineer.

J. A. McMonnies, who is at the head of the appliance department just opened by the Great Western Power Company, will leave shortly on an extensive Eastern tour, in the course of which he will secure valuable information in his lines.

A. J. Bowie Jr. is visiting Southern California for the purpose of supervising the preparations for installing a number of 150,000-volt Bowie switches on the new transmission lines of the Southern Sierras Power Company, which are being built by Manifold & Poole, engineers.

George C. Holberton, district manager of the Pacific Gas & Electric Company at San Francisco, recently acted as host to a party of prominent Chinese, including General Lan Tin Wei. After the visitors had inspected several of the company's electric stations they were entertained at a luncheon. On the same afternoon the party made an automobile tour of the east shore of the bay as guests of Traffic Manager Keith of the Oakland Traction Consolidated system.

Electrical men attending the Bohemian Club high jinks at Bohemian Grove, California, this week include **John A. Britton**, vice president and general manager of the Pacific Gas and Electric Company; **Chas. N. Black**, vice president of the United Railroads; **W. D'A. Ryan**, illuminating engineer with the General Electric Company; **G. L. Bayley**, chief mechanical and electrical engineer for the Panama-Pacific Exposition; **Wynn Meredith** and **R. S. Buck**, of Sanderson & Porter; **A. M. Hunt**, consulting engineer; **C. L. Cory**, consulting engineer.

JOVIAN LUNCH CLUB, SAN FRANCISCO.

A large and enthusiastic meeting of the Rejuvenated Sons of Jove was held at noon on August 6th obedient to the call of T. E. Bibbins, statesman-at-large. A general discussion was held regarding the feasibility of holding a weekly lunch, a committee consisting of C. F. Butte, R. M. Alvord and A. H. Halloran being appointed to report at a lunch on August 20th.

REPORT OF INTERNATIONAL CONGRESS COMMITTEE.

Your Executive Committee takes this occasion to report progress in negotiations with the Panama-Pacific International Exposition Company in regard to the 1915 International Electrical Congress. Through the energetic efforts of Vice-President Lardner, we have been officially advised by the officials of the Exposition Company that suitable auditoriums and other facilities will be made available for our purpose during the week beginning September 13, 1915. The status of Exposition plans is not yet such as to permit specific assignments, but we are assured that our interests are properly safeguarded and that the Exposition authorities will do everything possible to make certain the success of the Congress in so far as it may lie within their power.

Tentatively the following list of Sections has been prepared in order to assist in considering plans for Congress organization and program:

1.—Lighting and Illumination, including Electric Lighting of all kinds, electric radiation, etc.

2.—Generation, Transmission and Distribution, including hydroelectric plants, steam stations, transformers, substations, etc.

3.—Electric Traction and Transportation, including propulsion and electric vehicles.

4.—Electric Power, including the application of electric motors to industrial purposes.

5.—Economics, including load factors, power factors, and all problems affecting the economy of electric distribution, also regulation by Public Service Commissions, etc.

6.—Machinery, Transformers and appliances.

7.—Telegraphy and Telephony, including all communication and signalling by wires.

8.—Wireless Telegraphy and Telephony, including all communication by electromagnetic waves without wires.

9.—Electro-chemistry and Electro-metallurgy, including electric furnaces.

10.—Electric Measurements and Instruments.

11.—Protective devices and Transient and High Voltage Phenomena.

12.—Miscellaneous.

THE ELECTRICAL CONTRACTORS' DEPARTMENT

METHODS OF ESTIMATING.

BY W. S. HANBRIDGE.

In speaking of our recent trip to Denver to attend the National Electrical Contractors' Association Convention, if I were asked to put the entire proceedings into as few words as possible, I would say:

Co-operation to improve quality and service and education of the electrical contractor to be just to himself and to the consumer. Quality and service I feel can be handled together and I would say that some could divided as follows:

First—to cut out personal likings in purchasing stock which the consumer wants. Second—To buy nothing you can't sell at a profit. To cut out estimating for people who refuse to let you make a profit and to conserve your time by cutting out unneccessary estimating. Third—To turn your stock over as often as possible. Fourth—To give full and exact measure—no more, or no less—at each transaction. Fifth—To know your cost and what makes them and to cut them as low as possible without sacrificing quality and service to the consumer and justice to yourself.

To follow up the above, taking the first section—how often does an architect specify a certain kind of switch, and how much time do you consume telling him that something else is just as good? Don't you think it would please him more if you gave him what he wanted, instead of telling him that you buy the other kind in large quantities and that it would cost you a few cents more to give him what he wants? You may get him to grudgingly allow you to use what you want but I think that he would be much better satisfied if you gave him what he asked for. There are many things that a contractor spends more money and time trying to substitute than the difference in the cost of the article which is specified against the article substituted and then again often the article substituted is inferior to the article specified. My suggestion is to stop substituting. Give your customers what they ask for, and stop letting genial salesmen tell you what your customers need, but let the customers do the specifying and you give them the service by supplying them with what they want.

When a customer has no preference sell them the very best the market affords, therefore, educating them to a high standard, which means more profit for you and a very much satisfied customer.

Second—To buy nothing that you cannot sell at a profit. Summed up, means cut out unnecessary purchasing—unneccessary estimating and conserve your time so that it can be turned into more profitable channels. In other words I would say analyze your needs carefully, don't be so anxious to tie up your money and credit every time a salesman offers you an additional 10 per cent on any article, before purchasing make sure of two things—first, can I turn it over soon enough to pay me for tying my money and credit up, and second and most important—am I really saving any money?

In these busy times some people have a notion that they are making money by buying cheaply and these same people think that at any time they can get an article 5 or 10 per cent cheaper than the market price, that they are making money and they lose all sight of the fact that often the quality is not there, that depreciation and interest on the investment often make a cheap article expensive by the time it is turned over, and last, but not least, often Mr. Shrewd Buyer ties up his money or credit in such a manner that his assets are really the stock on his shelves, which in a pinch are worth considerably less than either the cash or his credit.

In reference to reckless estimating analyze the people to whom you are sending your estimates, remember it costs money to prepare a proposal. If a man accepts your proposal he usually expects you to live up to it to the letter; so, therefore, why should you not enter into a contract with him before you give him a proposal. You giving your time and money to prepare a careful estimate; he giving you an absolute square deal. Agreeing not to "peddle," and if you are the lowest bidder, give you the job. I would say cut out all who do not give you this treatment.

Third—Turn your stock over as soon as possible; now if you can buy an article today, put it in the job tomorrow, collect for it the next day, pay your jobber the next day, you would have reached the highest point of efficiency known in the business world, but as this is impracticable, I would say, buy only what you need, install and bill as promptly as possible, get a reputation for collecting promptly and also a reputation for paying your bills promptly. I think that if the average contractor would observe these four rules they would make more money than by trying to beat the game by quantity purchases, which usually lay on shelves a long time.

Fourth—To give full and exact measure, no more, no less; it is a big subject and could be covered in a paper by itself, but I would say to the electrical contractor, figure your plans and specifications carefully and honestly make notes of what you know to be technical errors, and do not sign up a job until you have a thorough understanding in writing of every one of the technical errors.

In making the above statement I do not deem it necessary for the electrical contractor to have second sight and take care of things that architect and owner have not thought of, but I do think that when a man calls in an electrical contractor for an honest estimate he is entitled to such suggestions that will give him a perfect job of wiring covering the results specified.

In reference to additions to plans and specifications. After having a perfect understanding the electrical contractor is entitled to an extra for everything added and the owner is entitled to nothing which is not specified. On all extra work there should be added a reasonably fair profit. A contractor must be just to himself and he must be fair to his customer, and the evils that exist in billing extra work has caused a loss of more customers than any other known evil. I personally believe that an extra is nothing more than part of a contract and that a contractor is entitled to the same profit as his original contract allowed him, of course, speaking now, that he has been fair with himself in figuring the original contract. But to the contractor who takes contracts at a low margin of profit in order to get the extra work, I will say that I believe that some day a bright attorney will spring the defense in some of our courts, that a man is entitled to no more profit on his extras than he originally asked for on his contract, and I feel that a judge in rendering a decision along that line would do so on the grounds that the contractor had established his own price.

It is absolutely necessary at all times to keep customers satisfied as it is much easier to lose a customer than gain a new one, so by being consistent in your charges, rendering good services, keep the quality up to standard, you will gain the confidence of your customer.

Fifth—To know your costs and what makes them. I am not going to enter into this subject as it will surely be covered today, but to emphasize what will be stated later, that knowledge is power, can never be illustrated any better than in the above clause. Know your costs and what makes them, gives you the power that is necessary to do a thing because it is right and remember only those things live

which are based on right, viz: You may have a perfect working organization, your secretary may be able to tell each one of you what is the right thing to do and even by pressure make you add enough profit so that you cannot lose money, but it will only live and grow stronger when it stands out in the minds of each member braced on all sides by a perfect knowledge of costs, then each member will be a support unto himself and will do things because he has the knowledge that if he does otherwise he will hurt himself, and leaving out the gambler's chance, no man will do anything knowingly which will injure himself.

When you have learned your own cost do not be afraid to help your competitor learn his cost; by doing so you are helping yourself as well as he, and furthermore, to the man who knows his cost and of what they are composed, he approaches a prospective customer with that confidence that gives the customer confidence in him and when you have obtained the confidence of a prospective customer, half the battle is won. To my mind it does not require the art of salesmanship to land business for an electrical contractor, but it does require a broad-gauged man, who has confidence in every statement he makes; first, because he knows his business as an electrician; second, because he knows the elements of his business and of what they are composed and the result is when he tells a prospective customer that a job will cost a certain amount, he has cut out all chances of argument and therefore, is not an easy prey to the shopper or "peddler," but is ready to advance arguments of quality and service in place of reducing prices.

In concluding I would say that if the first paragraph, or if you will allow me to repeat, co-operation to improve quality and service and education of the electrical contractor to be just to himself and the consumer, were made the matter of this organization, and if each and every one of us would jot it down on our calendars, keep it ever before us, boost it where and whenever we could, the time would not be far distant when it would be considered an honor and not a duty to belong to the California State Association of Electrical Contractors.

The following numbers won gate prizes at the Electrical Trades picnic and have not been claimed: No. 181, an electric portable lamp stand; No. 512, a toaster; No. 216, an electric portable lamp stand. Parties having above tickets can get prizes at Room 1408 Merchants National Bank building.

TRADE NOTES.

J. A. Barker is in charge of the construction of the Pacific Gas & Electric Company's new substation at Woodland. The last of the concrete for the structure has been poured and the machinery will be installed in the near future. Current will be supplied from this station to the Vallejo & Northern Railroad Company, of which T. T. C. Gregory is president.

The Pelton Water Wheel Company has been awarded a contract by the Southern Sierras Power Company for installation at Power House No. 3, one Pelton tangential water wheel which is to develop 2850 h.p. under a head of 290 ft. at 164 r.p.m. A water wheel for an exciter set is also included in the contract. An Allis-Chalmers generator will be direct-connected to the water wheel.

The Allis-Chalmers Company recently sold the Hammond Lumber Company complete steam-driven electric equipment for its new wood-working plant at Los Angeles. The apparatus contracted for includes: One 24 x 42 in. Corliss engine, directed connected to a 575-kw. alternating-current generator, and a number of induction motors aggregating 900 h.p., complete with exciter and switchboard. A large sash and door factory and a planing mill will be electrically operated.

The Pacific Light & Power Company, which recently contracted with the Allis-Chalmers Company for four large impulse water wheels for the Big Creek development, has issued specifications for the steel pressure pipe lines for four generating units. Fully six million pounds of steel will be used in the construction of four lines of about 4400 feet each. There will be several sizes of pipe running from 84 in. down to 24 in. There will be a drop of 1960 feet in the pipe lines leading down to the two power houses that are being installed at a point about 70 miles from Fresno. It is reported that the General Electric and Westinghouse electrical apparatus will be installed.

NEW CATALOGUES.

Sprague Electric Grab Bucket Cranes are illustrated and described in Bulletin No. 902 from the Sprague Electric Works. These machines "can shovel, lift, convey, deposit and pile" and are equipped with a simple, fool-proof control.

Bulletin No. 149 from the Crocker-Wheeler Company, is devoted to Form H Direct Current Motors and Generators. These motors are for 50 h.p. and more and are provided with commutating poles so as to be sparkless without shifting the brushes.

Engineering Data on Modern Illumination is the subject matter of Handbook No. 409 from H. W. Johns-Manville Company, a lose-leaf binder containing tables, diagrams, illustrations and facts on the application of Frink reflectors and J.-M. Linolite system to industrial lighting problems. Catalogue No. 410 from the same company is devoted to Modern Store Illumination and contains many illustrations of reflectors and lamps.

The Westinghouse Electric and Manufacturing Company is issuing a series of descriptive leaflets on the application of electric motors to paper mill service. No. 3505 just issued covers their application to Jordans. Circular 1516, attractively bound in an art cover, is devoted to electric locomotives, as built by the Westinghouse Company jointly with the Baldwin Locomotive Company of Philadelphia. This publication discusses the field of application of the electric locomotives to both steam and electric railways and shows numerous applications on roads throughout the country.

The Westinghouse Electric & Manufacturing Company has just issued a series of Descriptive Leaflets (Nos. 2465 to 2473) illustrating the new line of switchboard seven and nine-inch indicating meters. No. 2494 fully illustrates and describes the Westinghouse Synchronous Booster Rotary Converter. This machine consists of a standard converter in combination with a revolving armature alternating current generator mounted on the same shaft with and having the same number of poles as the ammeter by means of which the direct current voltage delivered may be varied. Commutating Pole Direct Current Motors (Type QM) for compressors, blowers, pumps and similar classes of service are fully illustrated and described in leaflet 2499.

THE KELLOGG HOWLER.

Telephone companies are oftentimes annoyed by subscribers leaving the receivers off the hook—time is lost and the service is more or less impaired. The Kellogg Switchboard & Supply Company has recently issued a four-page folder descriptive of their "howler" equipment which is effectively used in remedying this evil.

"Receiver off! Don't send a man," reads the front cover. "Have a Kellogg Howler to signal your subscribers who leave their receivers off hooks." In addition to this description on the cover is an illustration of a wire chief at his desk (just about to work the "howler"). Below this is shown the absent-minded subscriber reading his paper and—the receiver off the hook.

On the second page is a halftone illustration of the simple apparatus necessary. Pages two and three are given over to description. Kellogg extra heavy moisture-proof cords are mentioned on the fourth page. The type matter, border rules and illustrations are printed in brown ink and the booklet is a forceful sales argument.

INDUSTRIAL

POWERFACTOR METERS.

A poor powerfactor can often be improved by a better proportioning of the motors to their load, the use of a super-excited synchronous motor or similar means, with resulting increased capacity and efficiency of the system. It is therefore important, particularly in heavily loaded plants, to know what the actual powerfactor is at various conditions of load. To do this, it is not necessary, as it once was, to take readings of voltage, current and power and to calculate from these the ratio of true to apparent watts. The introduction of direct reading powerfactor meters has made calculation unnecessary and enables the determination of the powerfactor without trouble. Their use indicates whether induction motors on a system or on any circuit of a system are being properly operated, and enables the adjustment of the exciting current of synchronous apparatus to values giving the most economical powerfactor, also indicating a reversal of power if it occurs.

Fig. 1—7-inch Power Factor Meters.

Fig. 2—9-inch Power Factor Meters.

Of polyphase systems supplying a mixed load, powerfactor indicators are a necessity, as the calculation of powerfactor from other meters is complicated and difficult and may give very misleading results. A polyphase powerfactor meter having current connection in each phase of the circuit will indicate the average powerfactor of all the phases.

The illustrations show two types of direct reading powerfactor meters manufactured by the Westinghouse Electric & Manufacturing Company. These meters indicate on a graduated scale the powerfactor in the circuit to which they are connected.

The powerfactor meter operates on the rotating field principle. A rotating field is produced by the current of the metered circuit passing through angularly placed coils. In this rotating field is situated a pivoted iron vane or armature, magnetized by a coil whose current is in phase with the voltage of one phase of the circuit. As the iron vane is attracted or repelled by the rotating field of the current coils, it will take up a position where the zero of the rotating field occurs at the same instant as the zero of its own field. Thus its position will always indicate the phase angle between the voltage and current of the circuit. The pointer attached to the armature, therefore, indicates this angle, and, by marking on the scale the cosine of the angle shown by the graduation, the powerfactor is read directly. In the three-phase meter the rotating field is produced by three current coils spaced 60 degrees apart; in the two-phase meter, by two current coils spaced 90 degrees; in the single-phase meter, the position of voltage and current coils is interchanged and the rotating field is produced by means of a split phase winding.

Fig. 3—Movement of Power Factor Meters.

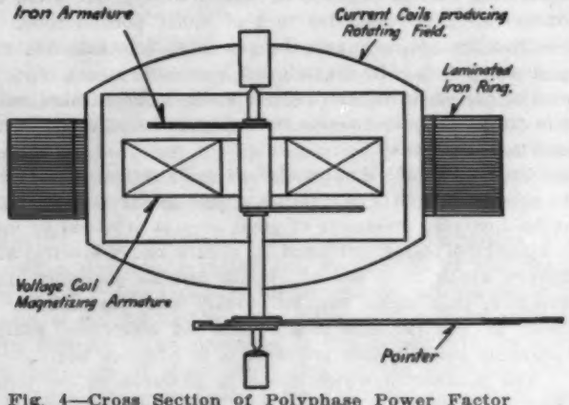

Fig. 4—Cross Section of Polyphase Power Factor Meter.

Fig. 3 illustrates the movement of a type SI seven-inch powerfactor meter. The winding shown within the iron ring is the stationary winding of the current coils. Inside this, and not shown, are the stationary voltage winding and the pivoted armature. The laminated iron ring surrounding the winding is provided as a return circuit for the flux of the pivoted armature, so that the reluctance of the armature magnetic circuit is low and uniform in all positions. These parts are shown in the diagramatic cross-section, Fig. 4.

The aluminum disk shown in Fig. 3 at the front of the meter is a damping disk moving in the concentrated field of the two permanent magnets at the bottom of the mechanism. These magnets and disk have no effect whatever on the electrical operation of the meter. They serve to absolutely prevent oscillations of the pointer, and thus make the readings "dead-beat." The pointer, therefore, does not swing back and forth but comes to rest at once at its correct position. More efficient damping is obtained with this electromagnetic device than is possible with air damping devices unless a delicate and easily deranged adjustment is resorted to.

OZONE AND HOW IT IMPROVES VENTILATION.

In addition to an adequate amount of fresh air, the proper ventilation of shops, factories and other types of industrial plants require in many cases the use of a suitable deodorizing agent. Particularly is this so of such places as glue factories, abattoirs, and fertilizer factories, where foul smells abound, or where pungent and offensive fumes are in evidence. Great expense is also involved in maintaining proper temperature conditions and keeping the air pure, in order not to seriously impair the health of the employes.

Many observers have noticed a peculiar penetrating odor in the atmosphere during the passage of a thunder storm, and various causes have been attributed to it. Physicists have discovered that this same odor is produced when electrical discharges are passed through the air or oxygen. Schoenbein identified this odor as being that of a gas, which he named ozone, from the Greek word signifying smell. In his experiments, he proved that it was one of the most rapid and powerful oxidizing agents known to science. The method of production and general characteristics of ozone being known, it was natural for the scientist to produce it artificially as an aid to ventilation. The remarkable electrical developments have been of much assistance to him, and the ozonator, or electric ozone generator is the result.

Ozone is a colorless gas with a sharp penetrating odor, resembling that of chlorine in high dilutions, but when more concentrated, it resembles that of moist phosphorous. The chemical symbol is O_3 and the gas is an unstable one under most conditions. It consists of 3 oxygen atoms, and is a form of oxygen in its most active state—concentrated oxygen. It is one of the most active oxidizing and deodorizing agents known to science.

Ozone is produced naturally by the lightning discharge and the same principle is used for its production artificially. An artificial lightning discharge of great area is provided by means of electrified plates, surrounding a field under electric stress through which air is passed. It has become generally known, therefore, that ozone can be quickly and conveniently produced by the passage of air between electrified surfaces. Apparatus built on this principle is in common use.

The manner in which ozone is produced in the General Electric Ozonator is interesting. A transformer raises the supply voltage to a point sufficiently high to operate the ozonizer, that part of the device is which the ozone is actually produced. This consists of a number of glass tubes coated with copper and containing aluminum vanes, separated from the inner walls of the glass tubes by small ring shaped air gaps. One of the high tension leads of the transformer is connected to the copper coatings of the glass tubes and the other is connected to the aluminum tubes. When the current is turned on, a violent electrical discharge occurs between the glass and aluminum vanes, and the energy of the electric field is absorbed by the oxygen of the air, producing ozone.

The action of ozone in destroying organic substances is so certain and rapid that ozone cannot exist except momentarily in air containing organic matter, hence the presence of ozone in the air is an indication that the air is not only sterile, but that gases and products of putrification have been reduced to harmless matter. It is therefore a powerful disinfectant in consequence of its oxidizing activity.

The General Electric Universal Ozonator for the purification of air consists of four essential parts, the ozonizer, a motor-driven blower, a step-up transformer and dust screen. The motor-driven blower with dust screen, together with fuses and controlling switches are mounted on the top of the wooden case and the ozonizer and transformer within the case, which is finished in flemish oak or imitation mahogany. The amount of ozone is most readily controlled by means of a simple 3-point switch, thus the amount of ozone produced can be easily regulated to suit different conditions.

Operating at full capacity the Ozonator gives a flow of 4000 cu. ft. of ozonated air per hour. This is sufficient to sterilize and deodorize the air in an enclosed space of 50,000 cu. ft., equivalent to that of the ordinary sized moving picture theater, bank or large school room. For larger spaces and storage rooms, or where decaying organic substances give off offensive odors and permit the growth of dangerous germs, the number of ozonators can be increased until the desired results are obtained.

The General Electric Household Ozonator is ideal in every respect for household use. It has been designed to meet the various conditions found in residences and by means of the 2-point switch, should take care of any possible condition which might arise.

The General Electric Ozonator provides an economical and effective aid in solving the general problem of ventilation. It purifies the air without setting up draughts, it can be as easily and conveniently installed as an electric fan, and occupies a small amount of space. The operating cost is nominal, and it is invaluable where good ventilation is essential to health and comfort. These Ozonators are distributed on the Pacific Coast by the Pacific States Electric Company.

NEW NELITE INDUSTRIAL REFLECTORS.

The Nelite "Dome" is the latest metal reflector of the Nelite Works of the General Electric Company. As the illustration shows, it is a very shallow type of porcelain enameled steel reflector, designed for service where the so-called flat types have heretofore been employed. Its scientific design, however, gives the dome type several advantages, chief of which are the minimum glare effect and the desirable distribution of light, both of which are secured at no sacrifice of efficiency.

The dome type Holophane-D'Olier reflectors are particularly adapted to service in rooms with low ceilings or where the total area to be lighted is large in comparison with the distance between units.

Nelite Dome Reflector

The Nelite Works has greatly improved its steel department manufacturing facilities and methods, since taking over the Holophane business. Heavier steel is now used in the construction of all the smaller sizes of metal reflectors; a method of galvanizing has been perfected whereby the bodies of aluminized reflectors are rendered impervious to moisture and fumes, and an oxi-acetyline process of welding the holders to the reflector bodies is now employed, which makes the finished units as solid as a single piece of metal.

These developments have been carried on under the direction of Mr. Henry D'Olier, Jr., who promises further improvements in the Nelite lines of metal reflectors within the next few months.

NEWS NOTES

INCORPORATIONS.

BURBANK, CAL.—Burbank Electric Light and Power Company, $20,000, subscribed $300, by G. H. Deacon, W. Coryell, F. A. Faust, Laura Coryell and Helen M. Deacon.

ONTARIO, CAL.—The Pacific Electric Heating Company of this city has filed new articles of incorporation, changing the name to the Hotpoint Electric Heating Company. Directors are E. H. Richardson, N. R. Richardson and Franklin Booth. Capitalization is $312,500.

REDLANDS, CAL.—With a capital stock of $1,500,000 the Citrus Belt Gas Company has been formed with F. P. Morrison of Redlands, E. S. Moulton of Riverside, M. Ham, E. D. Roberts and Z. T. Bell of San Bernardino, directors. On August 1 the San Bernardino Valley Gas Company sold the property to the Citrus Belt Gas Company for $470,000.

ILLUMINATION.

OAKVILLE, WASH.—A. Welland has asked the city for a light franchise and will install a plant.

BURBANK, CAL.—G. H. Deacon was the successful bidder or an electric light and power franchise in this city.

ALHAMBRA, CAL.—Construction will begin at once on nearly four miles of projected lighted way between this city and Los Angeles.

BEAUMONT, TEX.—A lighting franchise has been granted to Stone & Webster for a 25-year extension of their electric lighting system.

HERMISTON, ORE.—J. A. Ralph, who recently disposed of his electric light and power company, in Dayton, Wash., has purchased the interest of Lee Shupe in the Hermiston Light & Power Company. The system will be thoroughly overhauled and extended and new lines built.

MANSFIELD, WASH.—Bids will be received up to August 15, 1912, for the purchase of general town bonds in the sum of $10,000, denominations not less than $100 nor more than $1000, due in twenty years, issued to acquire the plant of the Mansfield Water & Light Company.

LOS ANGELES, CAL.—Application has been made to the State Railroad Commission by the Imperial Valley Gas Company for permission to sell $200,000 worth of company bonds. The money is to be used in extending the corporation's service to include Brawley, Meloland, Holtville, Heber, Calexico, Seeley, Dixieland and Mexicali.

RIVERSIDE, CAL.—The Board of Public Utilities has followed up its recent action ordering all electric fans placed on meters, by instructing the superintendent of the municipal plant to have all lights now charged for under flat rates likewise placed on meters.

PORTERVILLE, CAL.—Actual transfer of the plant of the Home Gas Company of this city has been made to the new corporation, the Central California Gas Company. The new concern spent $30,000 here in paying off the old obligations of the company. A force of men is already at work putting in new mains which will carry gas to every residence and business house in this district, both in and out of the city limits. Within a short time work will be started on the high pressure system with which the gas is to be distributed to Exeter, Lindsay and Strathmore, and bettering the system.

SANTA CRUZ, CAL.—A complete reorganization of the officials, both local and district, of the Coast Counties Gas & Electric Company, which has been undergoing an adjustment during the past few years, went into effect on August 1st. As a result of the new plans for dividing the authority and segregating the work of the corporation, S. W. Coleman, who for the past few years has been the local manager, first of the old Santa Cruz Gas & Electric Company, later general manager of the Coast Counties Gas & Electric Company, doing business in three counties, will make his headquarters in San Francisco and will change his residence to Redwood City, probably about the middle of August or the first of September.

TRANSMISSION.

BOISE, IDAHO.—The Beaver River Power Company will build a brick building for a steam turbine station, also a brick substation.

KELSO, WASH.—The Washington-Oregon Corporation will extend its power line from this place to Chehalis and Centralia, a distance of 40 miles.

MOUNT VERNON, WASH.—The Stone & Webster Engineering Corporation has completed plans for six substations to be erected near this city for the Pacific Northwest Traction Company.

LOS ANGELES, CAL.—Eight bids on 7,000,000 lbs. of machinery and equipment for the municipal plant in San Francisquito canyon, now in process of erection, were received, the lowest bid being $300,000.

NAMPA, IDAHO.—The Beaver River Power Company, with a plant at Bliss, Idaho, will probably build its line through Nampa to Caldwall. If enough contracts are not secured here to warrant the service the line will be built from Boise to Caldwell direct.

OXNARD, CAL.—After once turning down an offer of $35,000 for its present lighting plant, when offered it by the City Trustees, the Ventura County Power Company has sent a message to the officials that it will accept that amount. The matter is to be taken up by the board within a few days and it is believed the voters will be asked to provide bonds to that amount for the purchase.

SANTA MARIA, CAL.—The Railroad Commission has rendered a decision granting the application of the Santa Maria Gas & Power Company for permission to issue bonds in the sum of $50,000 and to extend its service to the city of Arroyo Grande. The proceeds of the bonds will be used in the purchase of pipes and mains for the extension from Santa Maria to Arroyo Grande, for additional machinery and to refund floating obligations of $10,000.

NAPA, CAL.—The Great Western Power Company has filed suit in the Superior Court here against the city of Vallejo to condemn a tract of land in Wild Horse Valley, in this county for a right of way for the company's power line. The city of Vallejo owns the land. The company declares that it is necessary to cross this land in order to reach Santa Rosa with the line from Butte County. It asks the Court to determine the value of the land and condemn a sufficient tract for right of way purposes.

FRESNO, CAL.—A. G. Wishon has returned from a trip into Santa Barbara County for the purpose of securing franchises for the power line of the San Joaquin Light & Power Company, which is to extend to the coast. The power line will not only extend from Coalinga to the coast, but will have numerous branches on the coast, so that a network

of power lines will be spread through all the little valleys, into every town in the central part of the state, coast and even as far south as the Santa Maria oil fields.

SALEM, ORE.—The State Engineer, John F. Lewis, has put the official "O. K." on a project to develop 15,000 horsepower at the mouth of the Clackamas River. The scheme is being promoted by D. P. Donovan, late of Payette, Idaho, and it will call for an investment of $1,250,000. The money will be secured by stock subscription. The power, it is announced, will be used for general purposes, the state will collect under the grant 12½ cents per horsepower annually. The power is to be secured by flume canal five and one-half miles in length, which will give a sheer drop of 109 ft.

TRANSPORTATION.

ORANGE, CAL.—Maps of the Pacific Electric extension survey in and out of this city have been turned over to the local committee appointed to procure a right of way for the new electric road.

KLAMATH FALLS, ORE.—George C. Clark is one of the parties interested in building an electric road from Klamath Falls to Bonanza from 26 to 28 miles and to cost $10,000 to $12,000 per mile.

SEATTLE, WASH.—A resolution has been adopted by the City Council in which it is stated that franchises for street railway systems will be let to the highest bidder. Fifteen specified routes are included in the resolution.

PETALUMA, CAL.—Ground has been broken for the extension of the Petaluma-Santa Rosa electric road to the coast. The work was commenced near the Arthur Robinson ranch at Liberty and the road will be built westward to Two Rock. The work will be completed this year.

RIVERSIDE, CAL.—A vigorous denial has been entered here by M. A. Henshaw, President of the Crescent City Railroad Company, which proposes to build an extension connecting the Riverside-Bloomington electric line with Rialto, that it is in any way affiliated with the Pacific Electric Company.

TWIN FALLS, IDAHO.—I. B. Perrine has filed a trust deed for $3,000,000 running to the Central Trust Company, of Illinois, by the Twin Falls Railway Company, which means that the electric road from this place to Shoshone Falls will be constructed at once. Mr. Perrine states that the plans include a bridge 1180 ft. long and 540 ft. high a short distance below Shoshone Falls and the electric line extended to Jerome.

SAN FRANCISCO, CAL.—To further hasten the completion of the Geary street railway, the Board of Public Works has written to the Supervisors suggesting that bids be advertised for the building of the underground conduits planned to carry the feeders and cables for the railroad from Kearny street to Presidio avenue. These, it is estimated, will cost $533,850. The conduits will do away with much of the unsightly part of the overhead system.

PALO ALTO, CAL.—Fourteen engineers of the Fresno & Coalinga Tidewater Railroad surveying corps are stationed just north of Palo Alto and are working toward San Francisco laying out the line of a proposed railroad from the south. The survey follows the east line of the Southern Pacific to Santa Clara where it switches off to the bay line towards Mountain View and Palo Alto. It is stated that E. C. Shaw of Hollister has procured the right of way along the survey.

SAN DIEGO, CAL.—The San Diego, Riverside & Los Angeles Railway Company has arranged for the sale in Europe of $3,000,000 bonds, according to information given by that company in its application to the State Utilities Commission for authority to incur a bonded indebtedness of $8,000,000. All of these bonds are to be sold at 75 per cent of their face value. It has been announced here that Pursell will present to the San Diego City Council another bond to insure the construction of that part of his line within the city limits by November 1.

HANFORD, CAL.—Negotiations known to have been under way for some months looking toward the taking over of the Hanford and Summit Lake Railway Company by the Southern Pacific Company, have at length come to a focal point and, according to an announcement made to the employes of his division by Superintendent Worthington of Bakersfield, the H. & S. L. Railway's management has been undertaken by the Southern Pacific and will henceforth be a part of that company's San Joaquin Valley division. The recent sale of the James tract to the Graham interests of San Francisco for $3,000,000 and the taking over of the new road by the Southern Pacific Company bespeaks great things in the future of the fertile region in the southern portion of Fresno County. The announcement is made that the Graham interest will immediately subdivide its big tract containing thousands of acres and pursue a colonization scheme to attract Eastern settlers.

TELEPHONE AND TELEGRAPH.

ELMA, WASH.—Mrs. H. B. Waldron was granted a franchise to erect a telephone line in certain portions of the county.

SAN FRANCISCO, CAL.—The Pacific Telephone & Telegraph Company on August 1 announced an increase in the wages paid to operators in San Francisco, Oakland and some of its other exchanges, amounting to over $125,000 per year.

LOS ANGELES, CAL.—Application has been made by the General Research Company for permission to erect two steel flag poles upon tops of some tall buildings down town, for the purpose of establishing a long distance wireless telephone; height of poles to be 100 ft.

SAN FRANCISCO, CAL.—At a recent meeting of the Supervisors Gallagher asked that the exact status of the city's legal action against the Home and Pacific Telephone Companies be reported to the board. Assistant City Attorney Geo. Lull, although not engaged on the telephone case, was present and stated that evidence and testimony were being gathered and prepared for the suits to break the alleged merger.

PHOENIX, ARIZ.—In pursuance of the agreement entered into between the Overland Telephone & Telegraph Company and the Mountain States Telephone & Telegraph Company, providing for the sale to the last named company of all the property and assets of the Overland Company for the sum of $432,000, W. C. Foster, as treasurer of the Phoenix Savings Bank & Trust Company, the trustee under the terms of the contract, has completed the final steps in the consummation of the contract, and all the telephone properties of the Overland Company have passed into the hands of the Mountain States Telephone & Telegraph Company.

WATERWORKS.

SAN DIEGO, CAL.—The Empire Water Company has applied for permission to construct a hydroelectric plant near Coyote Creek, San Diego County.

REDMOND, ORE.—The Election carried in favor of issuing bonds in the sum of $35,000 for a waterworks system and $10,000 for general municipal purposes.

HAILEY, IDAHO.—An ordinance has been adopted providing for a bond issue of $40,000 with the proceeds of which a municipal waterworks system is to be installed.

SAN DIEGO, CAL.—The State Railroad Commission has ordered a hearing on the application of the Southern California Mountain Water Company to sell out to the city of San Diego, naming the date as August 19. Under the terms of the agreement the city of San Diego is to purchase outright a portion of the plant for $2,500,000, and lease a portion of the plant for a period of ten years, on an option to purchase this portion at $1,500,000. A bond election will be held in San Diego August 15, when the proposition of purchasing and issuing bonds in the sum of $2,500,000 will be voted upon.